necessary to say now that it is a patient and elaborate investigation from original sources of the usually obscure history and origin of vegetable drugs. Those who best know how to appreciate the book find their admiration everywhere divided between its laboriousness and its perfect conscientiousness.

A life so spent leaves little else to record. He accompanied Dr. Hooker in a tour in Syria; in 1867 he was elected a Fellow of the Royal Society, and was a member of the Council at the time of his death. Of the Linnean Society he was vice-president and treasurer, and his place in it will not be easy to fill. The Society has passed through a somewhat serious crisis for a learned body. The change from the rather old-fashioned retirement of its rooms in Soho Square, and afterwards in the main building of Burlington House, to its present stately quarters, has produced a certain strain upon a constitution always essentially conservative. That difference of temperament between the members of successive generations which is a constant physiological phenomenon, found in Daniel Hanbury an exception. Perfectly cautious, he was perfectly free from prepossession, and no proposition—however revolutionary—seemed to him unreasonable if he could convince himself that it would add to the welfare of the body which he wished to see take the lead as the chief Biological Society of the country.

TWENTY-THREE HOURS IN THE AIR

THE longest aërial trip on record was made by the "Zenith," a balloon which ascended from Paris on Thursday, 23rd March, at half-past six in the afternoon, and landed at Montplaisir, near Arcachon, 700 miles from Paris, on the following evening at half-past five. The aëronaut was M. Sivel, and the passengers MM. Gaston Tissandier, the editor of *La Nature*, M. Albert Tissandier, his brother, an artist, and two other gentlemen.

The balloon drifted southwards from La Villette gasworks for a few miles, when, crossing Paris, it deviated in a westerly direction before reaching the fortifications. It then travelled south-west during the whole of the night, crossing Meudon, Chevreuse, Tours, Saintes, &c., up to the mouth of the Gironde, which was crossed at ten o'clock in the morning, 600 miles having been run in 15½ hours. The wind, which was not strong, having gradually diminished, the crossing of the Gironde occupied not less than thirty-five minutes. As the sun became bright and the weather hot, a brisk wind blew from the sea towards the land, but only up to an altitude of 900 feet. The aëronauts took advantage of this current to escape the upper current drifting towards the sea, and followed the margin of the Gulf of Gascony by alternate deviations obtained by changes of level.

Landing was accomplished without any difficulty by throwing a grapnel, and all the instruments were taken back to Paris. Most interesting observations have been taken, and will be described to the Academy of Sciences at an early sitting. But we are enabled to give a summary of these through the courtesy of our friend M. Tissandier.

A quantity of air was sent by an aspirator through a tube filled with pumice saturated with sulphuric acid in order to stop the carbonic acid and ascertain how many hundreds of grains are contained in each cubic foot. A series of experiments were made at different levels from 2,700 to 5,000 feet, the utmost height reached. The analysis will be made by a new method invented by MM. Tissandier and Hervé Mangon, a member of the French Institute.

The electricity of the air, tested with copper wires 600 feet long, was found *nil*, except at sunrise. It is known that at that very moment an ascending cold current is almost always felt.

The minimum of temperature was about + 25° Fahr.; at Paris, on the same night, it was about + 28° at the Observatory.

The moon was shining brilliantly, with a few cirrus clouds that manifested their presence by a magnificent lunar halo, which was observed from five o'clock to six in the morning.

The phenomenon gradually developed: the small halo (23°) showed itself first, and afterwards the large halo (46°), but as the aëronauts were at a small distance below the level where icy particles were suspended, the larger halo, instead of being circular, was seen projected elliptically. The dimensions of the smaller halo had been somewhat diminished. The horizontal and the vertical parhelic (or rather paraselenic) circles crossing each other at right angles on the moon, a cross was seen in the middle of a circle, and an ellipse concentric to it. The several phases of the appearance were sketched and will be sent to NATURE. The last part of the phenomenon was a cross, that remained longer than the two halos, which had vanished before the rising of the sun.

W. DE FONVIELLE

ON A PROPELLER IMITATING THE ACTION OF THE FIN OF THE PIPE-FISH [*]

THE peculiar mechanism of the dorsal fin of the Pipe-fish (*Syngnathus*) and Sea-horse (*Hippocampus*), Fig. 1, which is also known to be present in the Electric Eel (*Gymnotus*), has been referred to by more than one naturalist. In his "Handbook to the Fish-house in the Gardens of the Zoological Society," Mr. E. W. H. Holdsworth, speaking of the Pipe-fish, remarks that "they generally maintain a nearly erect attitude, supporting themselves in the water by a peculiar *undulating* movement of the dorsal fin;" and the late Dr. Gray, in the Proceedings of the Zoological Society,[†] also says that "they swim with facility, but not very rapidly, and they seem to move chiefly by the action of the dorsal and pectoral fins. The former is fully expanded when they move, and in very rapid motion, the action being a kind of wave commencing at the front end and continued through its whole length, continually repeated, so as to form a kind of screw propeller."

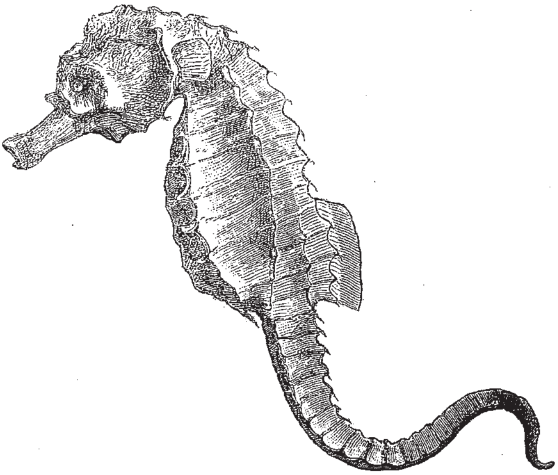

FIG. 1.—Side view of Branched Sea-horse (*Hippocampus ramulosus*), in which the dorsal undulating fin is clearly shown.

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[*] The substance of a lecture delivered by Prof. A. H. Garrod at the Royal Institution, March 16.

[†] P.Z.S. 1861, p. 238.

That an undulation travelling along a median fin must act as a propeller in a direction the reverse of that in which the wave travels, is evident; because each small section of the fin can be easily recognised to consist, as long as it is in motion, of an inclined plane of which the surface of impact against the water is at all times directed backwards as well as laterally, just in the same way that in sculling from the back of a boat the propelling surface of the oar is always similarly directed.

This undulatory motion of the fin is produced by the lateral movement, in a given constant order, of the spines which go to compose it; the movement being at right angles to the long axis of the body, and consequently at right angles to the direction in which the fish travels. A delicate membrane intervenes between each two spines, which participates in their changes in position, and forms the inclined planes above spoken of.

Each spine is swollen at its base, where it articulates with the corresponding interneural spine which is embedded in the substance of the animal, and runs sufficiently deeply to become situated between the spinous processes of the two nearest vertebræ. An elongate fusiform muscle runs from each side of the swollen base of the moveable spine, parallel to the spinous processes of the adjacent vertebræ, to be fixed at its proximal or deeper end to the body of the vertebra which is situated just beneath it. By the action of the one or other of the pair of muscles attached to each spine, the latter can be moved to the right or to the left of the body of the fish. A similar couple of muscles acts on each of the elements of the dorsal fin, which is not complicated by any additional machinery to produce the elegant movement observed when it is in action during life; this, therefore, must be dependent on the peculiarity in the nerve-supply, with which it is not as yet possible to associate any special structural organisation.

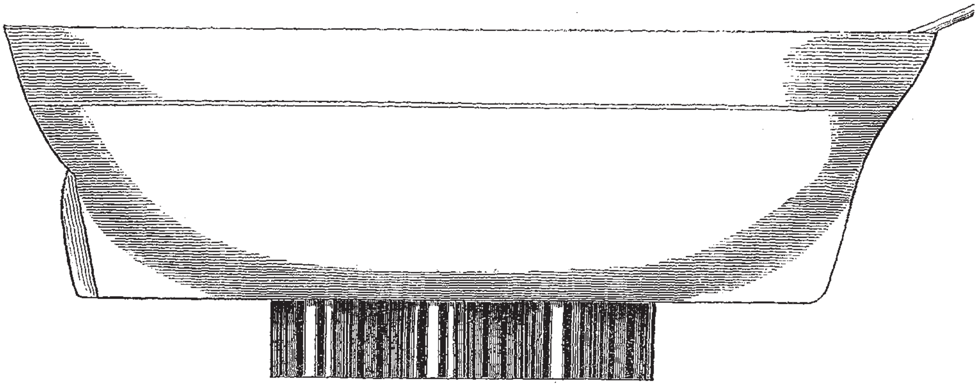


FIG. 2.—Side view of the boat constructed by Messrs. Elliott, with the undulating propeller described in the text.

It is not difficult to imitate artificially this undulatory fin of the above-mentioned fish. A series of rods hinged near their middle on a single axis will evidently represent at one end any movements given to them at the other. Therefore, if they are made to come in contact at one extremity with the side of a screw which is placed perpendicular to their direction, and at the same time is provided with projecting discs at right angles to its axis, one between every two rods, to keep them in place, the opposite tips will form an undulating curve, just in the same way that the ivory balls in the eccentric apparatus so frequently employed by lecturers on experimental physics, are made to represent the undulations of the atoms of the luminiferous æther in the production of light. Like this apparatus also, if the screw be made to rotate, an undulation will travel along the rods, which is exactly similar to that observed in the fin of the Sea-horse. Such a piece of machinery, driven by clockwork, ought theoretically to propel a boat if properly placed. Mr. C. Becker, of the firm of Messrs. Elliott and Co., has constructed such a boat, which is the property of the Royal Institution (seen sideways in Fig. 2 and from below in Fig. 3.) Its speed is slow, as is that of the fish; in the former case this is accounted for by the fact that the machinery is in this particular instance perhaps a little too heavy, at the same time that the friction developed in its action is very considerable. In the artificial fin there are just three complete undulations with eight rods in each semi-undulation, forty-eight in all. Between the rods the membranous portion of the fish's fin is represented by oil-silk. The rods and the other portions of the driving gear are so arranged that the former project, with their undulating ends and the oil-silk, in the middle of the boat, along the line of the keel. They form what may be termed a median ventral fin. The undulations are very complete, the curves being true semicircles. In the different species of Sea-horses and Pipe-fish the number of spines in the dorsal fin differ, being twenty or nineteen in *Hippocampus antiquorum*, thirty-seven in a most eccentric looking species described by Dr. Günther, and named by him *Phyllopteryx eques*, and

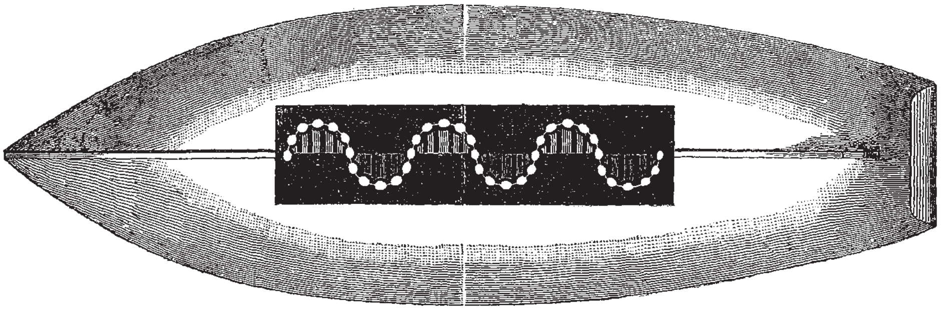


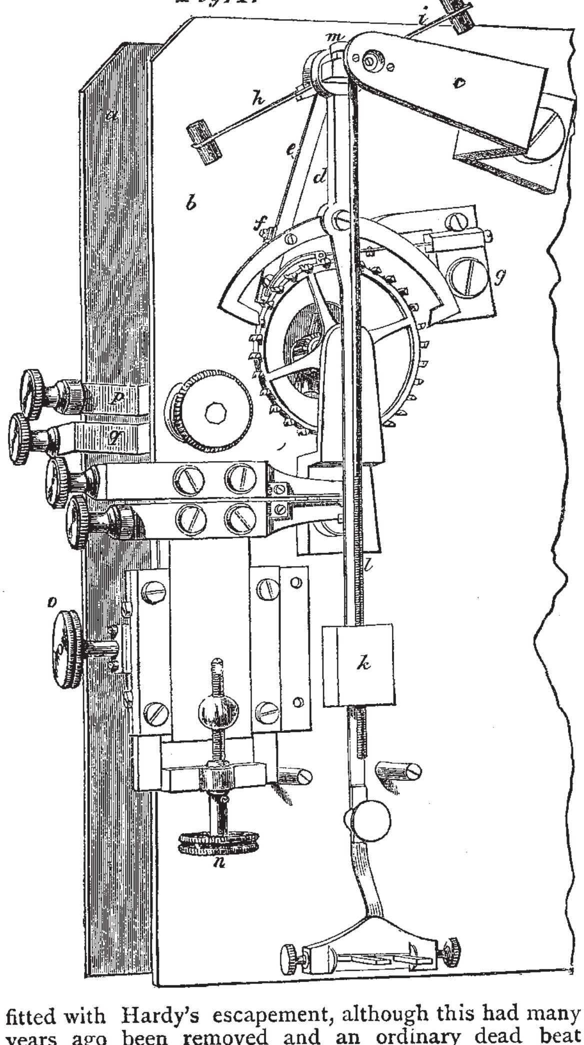
FIG. 3.—The same boat looked at from below, the apices of the rods forming undulating propeller being seen.

about forty in the great Pipe-fish (*Syngnathus acus*). In illustration of the amount of force expended in the working of its propeller, it may be mentioned that Prof. Lankester finds that it is only in the above-described muscles, by which it is moved, and in no other part of the body, that the red-colouring haemoglobin is to be detected.

THE NEW STANDARD SIDEREAL CLOCK OF THE ROYAL OBSERVATORY, GREENWICH

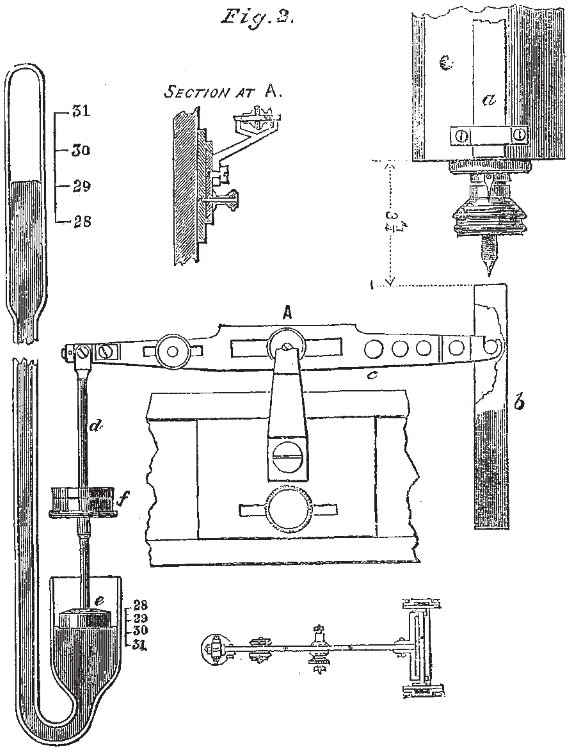
THE Royal Observatory at Greenwich has lately acquired a new standard sidereal clock which possesses several peculiarities of construction. The one formerly in use was that made by Hardy, and originally fitted with Hardy's escapement, although this had many years ago been removed and an ordinary dead beat escapement substituted. This clock was a celebrated one in its day, but of late years it seemed scarcely to satisfy modern requirements, and it was decided that a new one should be constructed. This has now been done. The new clock was planned generally by the Astronomer Royal, and constructed entirely by Messrs. E. Dent and Co., of the Strand. It was completed and brought into use in the year 1871, and both as regards quality of workmanship and accuracy of performance it appears to be an excellent specimen of horological art. As in the galvanic system of registration of transit observations it is unnecessary that the clock should be within hearing or view of the observer, the new clock has been fixed in the Magnetic Basement, in which the temperature varies only a very few degrees during the course of a year.

Fig. 1.



The pendulum is supported by a large and solid brass casting securely fixed to the wall of the basement, and the clock movement is carried by a platform forming part of the same casting. The Astronomer Royal adopted a form of escapement analogous to the detached chronometer escapement, one that he had himself many years before proposed for use,* in which the pendulum is free, excepting at the time of unlocking the wheel and receiving the impulse. Several clocks having half-seconds pendulum had since been made with escapement of this kind, but the principle had not before been applied to a large clock. The details of the escapement may be seen in Fig. 1, which gives a general view of a portion of the back plate of the clock movement, supposing the pendulum removed: *a* and *b* are the front and back plates respectively of the clock train; *c* is a cock supporting one end of the crutch axis; *d* is the crutch rod carrying the pallets, and *e* an arm carried by the crutch axis and fixed at *f* to the left-hand pallet arm; *g* is a cock supporting a detent projecting towards the left and curved at its extreme end; at a point near the top of the escape wheel this detent carries a pin (jewel) for locking the wheel, and at its extreme end there is a very light "passing spring." The action of the escapement is as follows:—Suppose the pendulum to be swinging from the right hand. It swings quite freely until a pin at the end of the arm *e* lifts the detent; the wheel escapes from the jewel before mentioned, and the tooth next above the left-hand pallet drops on the face of the pallet (the state shown in the figure) and gives impulse to the pendulum; the wheel is immediately locked again by the jewel, and the pen-

Fig. 2.



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* In the year 1827, in a paper "On the Disturbances of Pendulums and Balances, and on the Theory of Escapements," which appears in the third volume of the *Transactions of the Cambridge Philosophical Society.*